Australian Government
Australian Research Council

EI 2018 ENGAGEMENT AND IMPACT

Engagement and Impact 2018

Griffith University

GRF04 (ST) - Impact

Overview

Title

(Title of the impact study)

Tackling water quality threats to the Great Barrier Reef

Unit of Assessment

04 - Earth Sciences

Additional FoR codes

(Identify up to two additional two-digit FoRs that relate to the overall content of the impact study.)

05 - Environmental Sciences

Socio-Economic Objective (SEO) Codes

(Choose from the list of two-digit SEO codes that are relevant to the impact study.)

96 - Environment

Australian and New Zealand Standard Industrial Classification (ANZSIC) Codes

(Choose from the list of two-digit ANZSIC codes that are relevant to the impact study.)

05 - Agriculture, Forestry and Fishing Support Services

89 - Heritage Activities

Keywords

(List up to 10 keywords related to the impact described in Part A.)

Riverbank erosion

Sediment mining

Great Barrier Reef

Coupled human and natural systems

Light Detection and Ranging (LiDAR)

Sediment budget

Sensitivities

Commercially sensitive

No

Culturally sensitive

No

Sensitivities description

(Please describe any sensitivities in relation to the impact study that need to be considered, including any particular instructions for ARC staff or assessors, or for the impact study to be made publicly available after EI 2018.)

Aboriginal and Torres Strait Islander research flag

(Is this impact study associated with Aboriginal and Torres Strait Islander content?
NOTE - institutions may identify impact studies where the impact, associated research and/or approach to impact relates to Aboriginal and Torres Strait Islander peoples, nations, communities, language, place, culture and knowledges and/or is undertaken with Aboriginal and Torres Strait Islander peoples, nations, and/or communities.)

No

Science and Research Priorities

(Does this impact study fall within one or more of the Science and Research Priorities?)

Yes

Science and Research Priority	Practical Research Challenge
Environmental change	Options for responding and adapting to the impacts of environmental change on biological systems, urban and rural communities and industry.

Environmental change	Improved accuracy and precision in predicting and measuring the impact of environmental changes caused by climate and local factors.

Impact

Summary of the impact

(Briefly describe the specific impact in simple, clear English. This will enable the general community to understand the impact of the research.)

Along with climate change, poor water quality from catchment runoff is a major threat to the Great Barrier Reef (GBR). The Catchment Sediment Budget Research Team, headed by Associate Professor Andrew Brooks, has transformed how sediment sources are identified and targeted, resulting in a significant shift in federal and state government policy and practice. Specifically, the team identified gully erosion as the main human-accelerated source of sediment and nutrient source in the Normanby catchment. They pinpointed the coastal plain and estuaries as another sediment source. The team created widely adopted, inexpensive field tools and techniques, devised strategies for cost-effective 'hot spot' remediation and provided a scientific basis for a novel market-based approach to water quality.

Beneficiaries

(List up to 10 beneficiaries related to the impact study)

Federal government

State government

Government water quality experts

Traditional owners (new land management skills and landscape rehabilitation business opportunities)

Graziers

Resource management groups

Great Barrier Reef World Heritage Area

Australian citizens (maintenance of the national estate)

Countries in which the impact occurred

(Search the list of countries and add as many as relate to the location of the impact)

Australia

Details of the impact

(Provide a narrative that clearly outlines the research impact. The narrative should explain the relationship between the associated research and the impact. It should also identify the contribution the research has made beyond academia, including:
- who or what has benefitted from the results of the research (this should identify relevant research end-users, or beneficiaries from industry, the community, government, wider public etc.)
- the nature or type of impact and how the research made a social, economic, cultural, and/or environmental impact
- the extent of the impact (with specific references to appropriate evidence, such as cost-benefit-analysis, quantity of those affected, reported benefits etc.)
- the dates and time period in which the impact occurred.

NOTE - the narrative must describe only impact that has occurred within the reference period, and must not make aspirational claims.)

In 2004, a reconnaissance flight led by geomorphologist A/Prof Andrew Brooks up and down every river from Cape York to Arnhem Land fundamentally altered the direction of his research team. The scientific foundation of efforts to tackle the impact of poor water quality due to run-off on the Great Barrier Reef (GBR) was transformed by what Prof Brooks had seen. Observations and analysis of a network of giant gullies, some with walls 20 metres high, led to the view that sediment eroding from these gullies posed a risk to the water quality of the rivers and marine systems of northern Australia.

In 2009, the Catchment Sediment Budget Research Team began investigating the origin and impact of gully erosion on the surrounding landscape and the quality of the river water running into the GBR. To conduct the research, the team combined what James Cook University Professor Damien Burrows calls a “particularly interesting” range of innovative, low cost field and remote sensing techniques: aerial mapping, remote sensing, LiDAR, GIS mapping and modelling, geochemical and optical sediment tracing methods; the combination of techniques is now widely used by experts.

In this first study of its kind, the team measured the sources and endpoints for sediment in Cape York’s Normanby catchment, the fourth largest catchment draining to the GBR. The project, still ongoing with funding from the Australian and Queensland Governments, overturned previous belief that hillslope erosion is the dominant source of anthropogenic sediment to the GBR. The team demonstrated that, together, bank erosion and gully erosion, created over a century of cattle grazing, contributes more than 90% of sediment loads to the GBR. Hillslope erosion contributes less than 10%. The work also indicates some alluvial gullies can contribute nutrient enriched run-off to the GBR. The high nutrient concentrations have the potential to favour outbreaks of unwanted reef species like the crown-of-thorns starfish and drive reef damaging phytoplankton blooms.
Critically, the Catchment Sediment Budget Research Team demonstrated that ‘hotspots’ of erosion activity can be identified and remediated and indicated the resources needed to achieve sediment reduction targets. The outcomes of the research provided scientific underpinning for a possible market-based conservation strategy akin to carbon trading. “The work has informed $60 million of investment into the reef including grazing land and gully remediation,” says Dr Kevin Gale, Assistant Director, Reef Branch, Australian Government Department of Environment and Energy.

Professor Brooks and the team developed strategies for identifying and rehabilitating erosion hotspots. They demonstrated that instead of focusing on managing hillslope grass cover (the previous practice) the most efficient, effective and economic way to improve the quality of water flowing into the reef is to deploy techniques similar to mine site rehabilitation to restore gullies.

For instance, large-scale earthworks, conducted by properly funded and trained crews, can help regrade gullies to a gentler slope. Gullies can be capped with earth material like rock. Soil can be stabilised by adding organic matter such as compost, mulch and gypsum to chemically immobilise it, preventing sediments from dissolving into rivers. These techniques can reduce erosion by 75% in two years. The impact and value of the research carried out by the Catchment Sediment Budget Research Team at Griffith, earned the researchers the 2017 Eureka Prize for Environmental Research (based on research carried out from 2011-2016). It has also garnered praise from government organisations which fund environmental research and remediation projects.

Elisa Nichols, executive director, Qld Dept of Environment & Science, Office for GBR notes the new strategies give officials “confidence to invest” in land rehabilitation. They also help water experts “target the investments and action in the highest priority areas”. One of the major impacts of the research on the Normanby catchment is the Queensland Government’s 2016 purchase of Springvale cattle station in Cape York for rehabilitation. Comprising 2.3% of the catchment, it produces ~40% of the gully sediment. The state also agreed to review the now outdated computer model used to predict catchment erosion and water quality.

Beyond governments, the Griffith team collaborated with traditional landowners, graziers and catchment groups building skills and rehabilitation strategies. Among them is Balkanu Cape York Development Corporation, a not-for-profit group owned by the Cape York Aboriginal Charitable Trust on behalf of regional Aboriginal people. Enhanced knowledge of how to halt erosion and build the reef's resilience is of "real concern to traditional owners", says Balkanu Chief Operating Officer Terry Piper. He praises the leadership offered by the team. Graziers also benefit from the work, Program Manager of the Cape York NRM group, Will Higham, says the team's input is vital for "planning on-ground works, promoting the need for on-ground work, and promoting the issue of sediment management and awareness about doing something about gully erosion".

The projects by Associate Professor Brooks and colleagues have changed the way erosion is thought about and managed in the GBR catchments. Specifically, this work has completely turned around the prior notion that gully erosion was a minor component of the sediment budget in GBR catchments, by demonstrating that it is in fact, the dominant component of the sediment budget. In 2015 the team began applying lessons from the Normanby catchment to the Burdekin catchment in northern Queensland with state and federal funding.

Associated research

(Briefly describe the research that led to the impact presented for the UoA. The research must meet the definition of research in Section 1.9 of the EI 2018 Submission Guidelines. The description should include details of:
- what was researched
- when the research occurred
- who conducted the research and what is the association with the institution)

The Impact of work conducted by Griffith's Catchment Sediment Budget Research Team is built on comprehensive field work conducted in two major catchment areas in Queensland, the Normanby Basin in Cape York and the Burdekin catchment in northern Queensland across the reference period.

In order to obtain a sediment budget – the sources and endpoints of sediment - for the Normanby Basin the team conducted an empirical investigation of:
•Hillslope erosion assessment
•Gully erosion
•Stream bank erosion
•Sediment source tracing.

Similarly, the researchers determined a sediment budget for the Burdekin catchment which:
•Identified and mapped major aggregations of alluvial gullies in the Bowen catchment (~30% of the sediment load to the GBR)
•Identified high priority rehabilitation sites – now the focus of rehabilitation pilot projects, including the Stathalbyn Station
•Identified appropriate rehabilitation strategies based on mine-site rehabilitation procedures.

FoR of associated research

(Up to three two-digit FoRs that best describe the associated research)

04 - Earth Sciences
05 - Environmental Sciences

References (up to 10 references, 350 characters per reference)

(This section should include a list of up to 10 of the most relevant research outputs associated with the impact)

Brooks, A.P., Shellberg, J.G., Knight, J., Spencer, J. (2009) Alluvial gully erosion across the Mitchell fluvial megafan, Queensland Australia. Earth Surface Processes and Landforms, 34, pp. 1951 – 1969

Olley, J. Brooks, A. Spencer, J. Pietsch, T. Borombovits, D. (2013) Subsoil erosion dominates the supply of fine sediment to rivers draining into Princess Charlotte Bay, Australia. Journal of Environmental Radioactivity v 124 pp 121-129.

Brooks, A. Borombovits, D., Spencer, J., Pietsch, T., Olley, J., (2014). Measured hillslope erosion rates in the wet-dry tropics of Cape York, northern Australia Part 1: A low cost sediment trap for measuring hillslope erosion in remote areas - trap design and evaluation Catena, v122:1–17.

Brooks, A. Spencer, J., Borombovits, D., Pietsch, T., Olley, J., (2014). Measured hillslope erosion rates in the wet-dry tropics of Cape York, northern Australia: Part 2, RUSLE-based modelling significantly over-predicts hillslope sediment production Catena v122:42–53.

Pietsch, T.J., Brooks, A.P., Spencer, J., Olley, J.M., Borombovits, D. (2015) Age, distribution and significance within a sediment budget of in-channel benches in the Normanby River, Queensland, Australia. Geomorphology Volume 239, 15 June 2015, Pages 17-40.

6.Wilkinson S, Brooks A., Hairsine P, Crawford D, Bartley R, Pietsch T. (2016) Gully and Stream Bank Toolbox – A technical guide for the Reef Trust Phase IV Gully and Stream Bank Erosion Control Program, Commonwealth of Australia 2016.

7.Brooks, A.P, Spencer, J., Curwen, G, Shellberg, J., Garzon-Garcia, A, Burton, J. & Iwashita, F. (2016) Reducing sediment sources to the Reef: Managing alluvial gully erosion. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited, Cairns. 377 pp.

8.Brooks, A.P., Curwen, G., Spencer, J., 2015. A Framework for Prioritising Gully Management in the Normanby Basin Cape York. A report to South Cape York Catchments for the Cape York Water Quality Improvement Plan by the Australian Rivers Institute, Griffith University, 28 pp.

9.Brooks, A.P., Olley, J., Iwashita, F.// 2014a. Reducing Sediment Pollution in Queensland Rivers: Towards the Development of a method to Quantify and Prioritise Bank Erosion in Queensland Rivers based on field evidence from the Upper Brisbane, O'Connell and Normanby Rivers. Final Summary Report to Qld State Government, DSITIA, Griffith Univ.p 76.

Brooks, A.P., Spencer, J., Olley, J., Pietsch, T., Borombovits, D., Curwen, G., Shellberg, J., Howley, C., Gleeson, A., Simon, A., Bankhead, N., Klimetz, D., Eslami-Endargoli,// (2013) An Empirically-based Sediment Budget for the Normanby Basin: Sediment Sources, Sinks, and Drivers on the Cape York Savannah. Griffith University, 506pp.

Additional impact indicator information

Additional impact indicator information

(Provide information about any indicators not captured above that are relevant to the impact study, for example return on investment, jobs created, improvements in quality of life years (QALYs). Additional indicators should be quantitative in nature and include:
- name of indicator (100 characters)
- data for indicator (200 characters)
- brief description of indicator and how it is calculated (300 characters).)